



**Professional Analysis
and Consulting, Inc.**

4951 Indiana Avenue, Suite 600
Lisle, IL 60532

Project No. 2017

Brittany B. Hilton

v.

SIG SAUER, Inc.

Report Prepared for:

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Report Prepared by:

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Date of Report: August 15, 2022

Introduction

On December 1, 2020, Ms. Brittany B. Hilton was exiting her office at the Bridge City Police Department in Bridge City, Texas, where she was a detective. As she was moving around a small file cabinet the Sig Sauer P320 X Carry 9 mm pistol discharged un-commanded while fully secure in an approved holster in her purse causing severe and permanently disfiguring injuries.

Professional Analysis and Consulting, Inc. was retained to perform an independent investigation into this incident and to provide a report of our findings.

Professional Qualifications

Professional Analysis and Consulting, Inc. (Professional Analysis) is a technical consulting firm specializing in product performance and root cause failure analysis and prevention. The Curriculum Vitae (C.V.) of the author, along with his testimony list and fee schedule, are attached as Attachment A.

Timothy M. Hicks, P.E. is a Principal Engineer and has a diverse background in mechanical design and system evaluations, including accident reconstruction. He spent close to 20 years in various roles in the automotive industry, responsible for the design, manufacturing, testing, and validation of vehicle systems. He also has experience in leadership roles for commercial vehicle suppliers and manufacturers, including leading advanced engineering teams. In addition to significant product design experience, his experience also includes conformance to governmental regulations, product safety, maintenance and service requirements, and field performance investigations. As part of his consulting experience, he has performed numerous investigations for incidents involving firearms, and certification tests on firearms and firearm safety devices, pursuant to the state of California and commonwealth of Massachusetts regulations. For the investigation described in this report, including other SIG SAUER cases, his investigation methods are in accordance with the generally accepted standards and practices of his field, including utilizing the scientific method.

Mr. Hicks is a Professional Engineer licensed by examination in the State of Illinois, and by comity in other states. He is an active member of the Society of Automotive Engineers (SAE) and has been elected as Chair of the Chicago Section in 2018 and has been reelected each year since. The Chicago Section numbers over 1,000 members. He is also a member of the American Society of Mechanical Engineers (ASME), and the National Society of Professional Engineers (NSPE). He also holds Certificates of Eligibility from the California DOJ Bureau of Firearms and Massachusetts Firearms Records Bureau Executive Office of Public Safety for analyzing and performing firearm certification testing for firearm manufacturers.

Materials Reviewed and Inspection Conducted

Attachment B, along with the footnotes and references herein, outline the materials reviewed by Professional Analysis with respect to this matter. This list includes materials compiled through Professional Analysis' own research. Several other similar incidents of un-commanded discharges have been captured on video and were also reviewed. These include a SEPTA police officer, a Roscommon, Michigan sheriff, and a St. Clair, Michigan

police officer. None of these incidents had the law enforcement officer with their hand/finger on or near the trigger.

On July 14, 2022, Professional Analysis attended the inspection of the subject P320 X Carry 9mm pistol, the Blackhawk Serpa CQC holster, and an empty casing. The inspection included photographs, measurements, and 3D CT scans. Mr. Peter D. Villani, a Sig Sauer certified armorer in P320, also attended this inspection who assisted with disassembly. Prior to this inspection, the firearm had been returned by the Bridge City Police Department to Sig Sauer for analysis. Throughout this report there are items mentioned that could not be quantified with the CT scan due to its resolution. It should be noted that additional measurements could be obtained with additional access to the subject firearm. However, the work performed to date is sufficient to support the opinions made.

After the CT scans, the firearm underwent basic functionality testing which was performed by the Sig Sauer expert under controlled laboratory conditions. These included items such as magazine catch, slide catch, magazine release, trigger function, disconnect function, and firing pin function. The firearm was also cycled 101 times while holding it, then pushing and pulling the slide assembly against the grip module. After these basic functional tests, the trigger pull force was obtained and was approximately 5.5 pounds. Functionality tests representative of expected and reasonable usage and loading conditions, with vibration or inertial forces while the firearm is holstered and used, and drop testing, were not performed.

Finally, the firearm was disassembled for further analysis. This allowed for detailed photographs to be taken of the various components discussed elsewhere in this report, which included the firing control unit, trigger mechanism, and striker assembly. The firearm was initially disassembled by the Sig Sauer expert, but the striker assembly was disassembled by Mr. Villani.

Background

On December 1, 2020, Bridge City Police Department Detective Brittany Hilton, an eleven-year veteran, had arrived at the police station around 8:00 A.M. After getting coffee and saying hello to some of her coworkers, she proceeded back to her office to prepare for a 10:00 A.M. statement from an assault victim. Around 9:15 A.M., Bridge City Police Captain Richard Teague stated he needed Detective Hilton to follow him to the Bridge City Radiator Shop to drop off a patrol vehicle for maintenance. Detective Hilton grabbed her purse and her keys and started to leave her office. Remembering her vehicle had an odor to it, she walked back to her desk to grab a bottle of body spray and placed it in her purse. With her purse straps over her right arm, and holding her keys with her right hand, she proceeded to leave her office again, when her Sig Sauer P320 X Carry 9mm experienced an un-commanded discharge while in a Blackhawk hip holster in her purse.¹

Captain Teague was just outside of Detective Hilton's office when the discharge occurred. He walked into Detective Hilton's office to witness her bending over and the exit wound on her buttocks. He noticed her purse and keys on the office floor next to her. He also looked in her open purse and saw the firearm on top, contained within the holster, and noted that there was nothing visible in the trigger area. He slowly pulled the holster with the firearm in it out of her purse, along with a cloth face mask had also attached to the barrel end. He noted that the mask had a hole with gun powder residue and powder burns on it. After assessing her injuries, and asking

¹ Hilton deposition dated July 12, 2022, pages 41, 52-66

others to call an ambulance, he provided basic first aid to control the bleeding. Within a few minutes, Bridge City Chief Paul Davis arrived and assisted Detective Hilton until the ambulance paramedics arrived.²

Captain Teague stated that he also noticed fabric on Detective Hilton's desk, as well as damage to the plastic carpet protector and carpet, and what appeared to be the bullet hole in the drywall. After the ambulance left with Detective Hilton, Captain Teague and Assistant Chief Robert Bergeron performed an inspection and photographed the office, purse and contents, and firearm. The firearm was removed from the holster, and they removed the magazine. They noticed that the empty casing from the expended round had not ejected and was still seated in the chamber.^{3,4}

During the July 14, 2022, inspection, the subject P320 X Carry 9mm was verified as having Serial No. 58A194116. This was an upgraded version of the P320 and was otherwise in as-produced condition, except for normal and anticipated wear since Detective Hilton utilized the subject firearm as her service weapon. Detective Hilton had significant qualification and training practice firing the weapon and was familiar with its operation and exercising proper firearm safety. As mentioned, Sig Sauer took possession and disassembled the subject firearm prior to the July 2022 inspection and prepared an inspection report.⁵

The P320 was Sig Sauer's first striker fired pistol design, introduced in 2014, and was based on the P250 frame, barrel, and magazine. In 2017, Sig Sauer was awarded a large military contract to supply two different versions of the P320 (M17 as a full size and M18 as a compact version), but the military required a redesign to address drop performance and to include a manual safety. No manual safety was present on the subject firearm. Over 50 other reported incidents of similar un-commanded (no trigger pull) discharges have been reported across North America, including several different law enforcement agencies, some of which have prohibited the further use of the P320 model by their officers.

In 2017, Sig Sauer initiated a voluntary upgrade program to change the trigger mechanism, along with changes to the safety lever and sear. Firearms produced after the date of the voluntary upgrade would have the design changes included, but anyone who had purchased a P320 before the upgrade would have to send the firearm back to Sig Sauer for the repair.

² Hilton dep exhibit 3 – Bridge City Police Department Interoffice Memorandum dated 12/02/2020, Captain Teague

³ *ibid*

⁴ Hilton dep exhibit 4 - Bridge City Police Department Interoffice Memorandum dated 12/28/2020, Asst Chief Bergeron

⁵ Hilton dep exhibit 5 – Sig Sauer Inspection Report



Figure 1 - Subject Sig Sauer P320 X Carry 9mm

Findings and Analysis

Examination of Detective Hilton's pistol identified several design and manufacturing defects, consistent with the previous P320 firearms inspected, which also fired un-commanded without the trigger being pulled. These defects support the claim of Detective Hilton and the Bridge City Police Department's findings of an un-commanded (no trigger pull) discharge of the firearm. The following items were identified:

1. The sear and striker pin components, the engagement of which is a critical feature of this design, are produced using a Metal Injection Molding (MIM) process and do not have any secondary machining performed on the small engagement surfaces. MIM produced components can have areas of uncontrolled variability due to the manufacturing process. For surfaces where tight tolerances and consistent fit-up are required, MIM parts will typically have secondary processing, or machining, to eliminate the variation. See Figures 2 – 3.

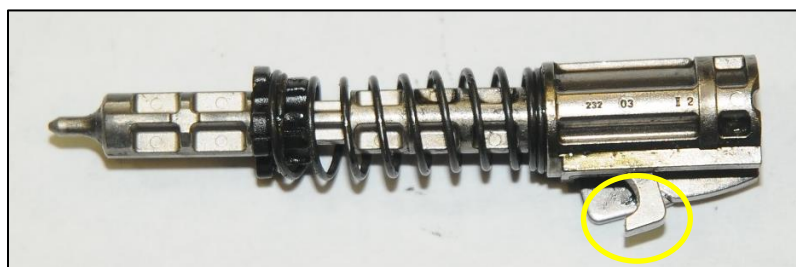


Figure 2 - Striker assembly with striker foot circled (left), striker assembly in the slide assembly (right)

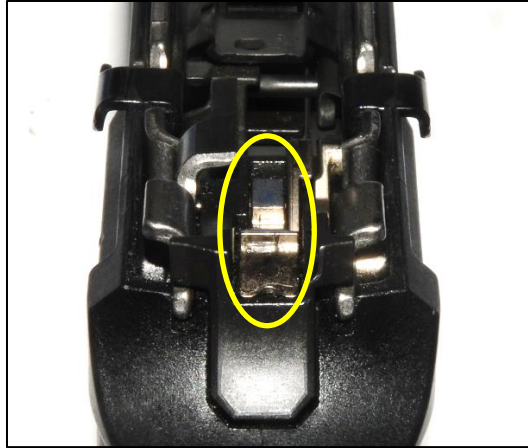


Figure 3 – Top rear view of sear (circled) and off-center striker drag marks

2. The sear and striker foot portion of the striker pin both exhibited inconsistencies on the surfaces that are in contact with each other, minimizing the actual contact surface area that is needed to keep the parts engaged until the trigger is pulled. In addition to the MIM as manufactured surfaces (rough and unmachined), both parts also exhibited a raised area around the periphery of the interface surface. This has been referred to by others as rollover and appears to be a combination of flashing, radiused corners, and shrinkage of the inner surface area. The end result is reduced contact surface area between both components, making the firearm more susceptible to un-commanded discharge. Figure 4 is a close up of the sear step with clear wear marks from the striker foot that shows an inconsistent pattern, including an area within the step with no wear. There is also an inconsistent surface along the top edge of the sear step. Figure 5 has zoomed in photographs of the subject striker foot showing the raised area around the periphery of the face, radiused edges, and an unmachined surface.

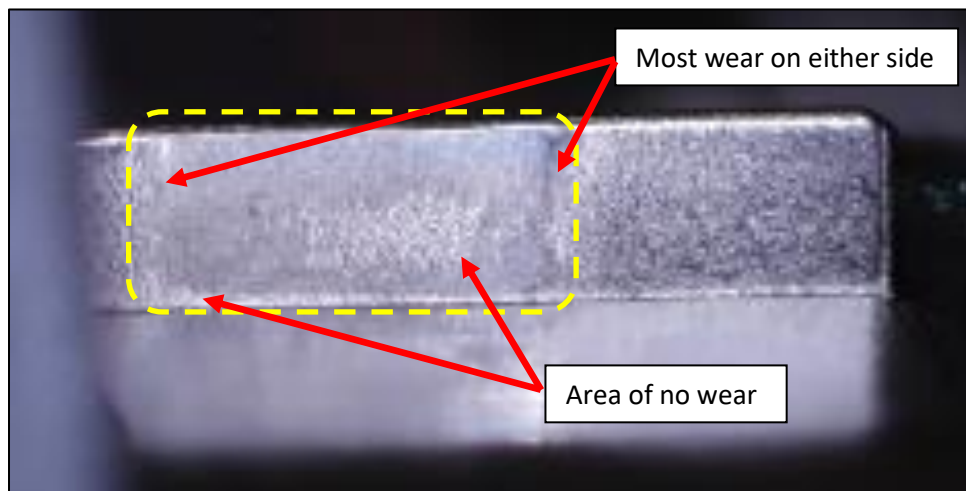


Figure 4 - Subject sear step with striker foot marks (outlined in dashed yellow)

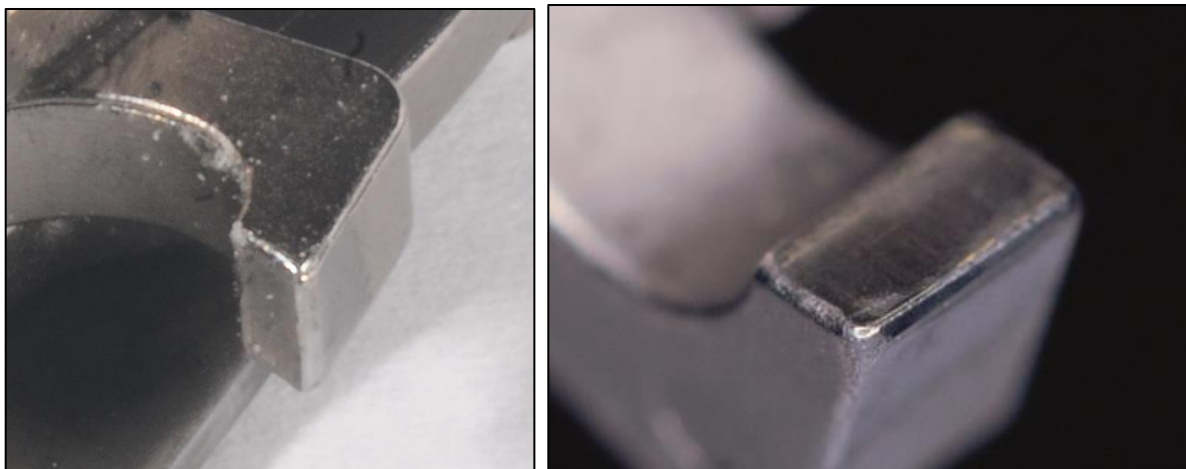


Figure 5 – Subject striker foot showing raised outline and unmachined surface

3. In comparison, the photos in Figure 6 show the machined (or some other secondary processing after molding) surface of the striker foot and sear from other manufacturers firearms. As mentioned, the CT scan is unable to be utilized in quantifying or measuring the inconsistencies of the surfaces of the striker foot or the sear step due to its resolution. Feature size and dimensions, including radiused corners, can be measured from CT scan, described more below.

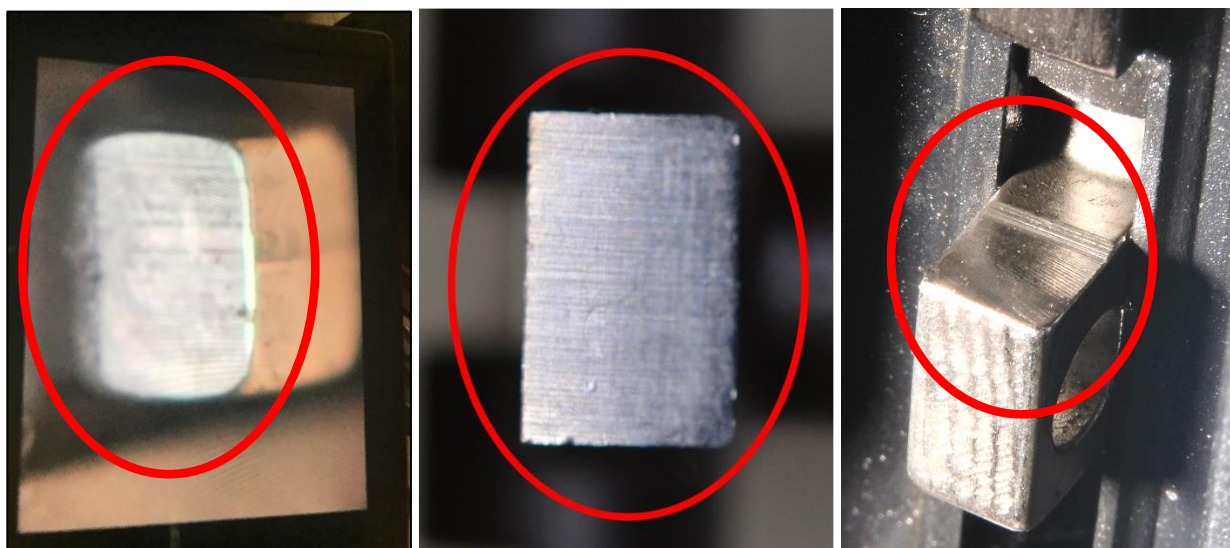


Figure 6 - Other firearms - striker foot (left), and sear face (center), and striker foot (right), all with machined flat surfaces

Additionally, the Sig Sauer Quality Control Document⁶ specifies that the trigger bar needs to be “*polished with no burrs*” but does not specify the same requirement for the sear or the striker pin. Sig Sauer recognizes the need to perform secondary processing on some parts of the P320 but choose to not do so on the sear or the striker pin. See Figure 7.

⁶ Bates SIG-QC 000060 – Sig Sauer P320 Assembly and Quality Inspection Master, rev. 23

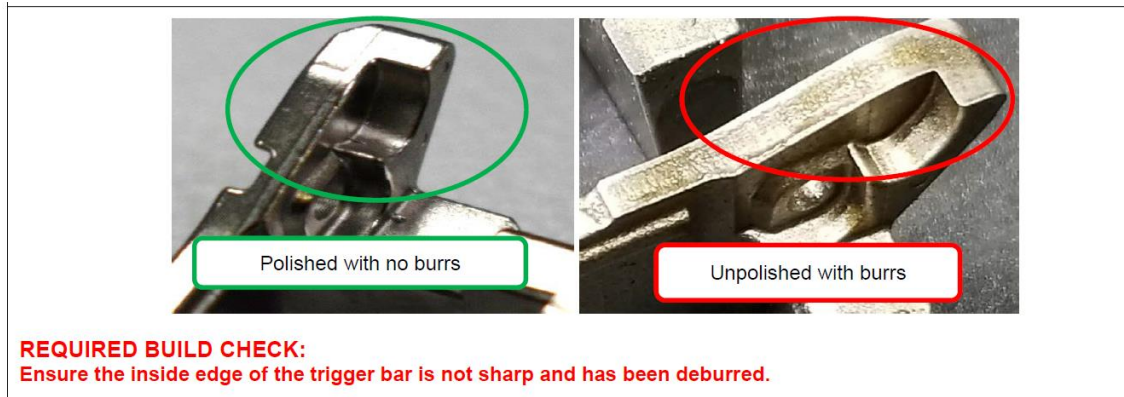


Figure 7 - Image from Sig Sauer P320 Assembly and Quality Inspection Master

4. A CT scan was also used to document the striker and sear engagement areas as compared to the drawings, shown in Figure 8. The sear step had the top surface, where the striker foot is released from, measured radius at 0.007" (0.18 mm), with the Sig Sauer drawing #1302192⁷ indicating a radius of 0.1 mm. The surface profile where the striker engages indicates a tolerance of 0.2 mm, but as with the other components discussed in this report, this dimension could not be quantified with the CT scan. The CT scan of the bottom edge of the striker foot radius measured at 0.009" (0.23 mm). The Sig Sauer striker drawing #1302193⁸ indicates that the radius on the bottom edge of the striker foot at 0.003" (0.1 mm). This drawing also indicates that the surface that engages with the sear step has a surface finish specification of 0.8, but this could not be quantified with the CT scan.

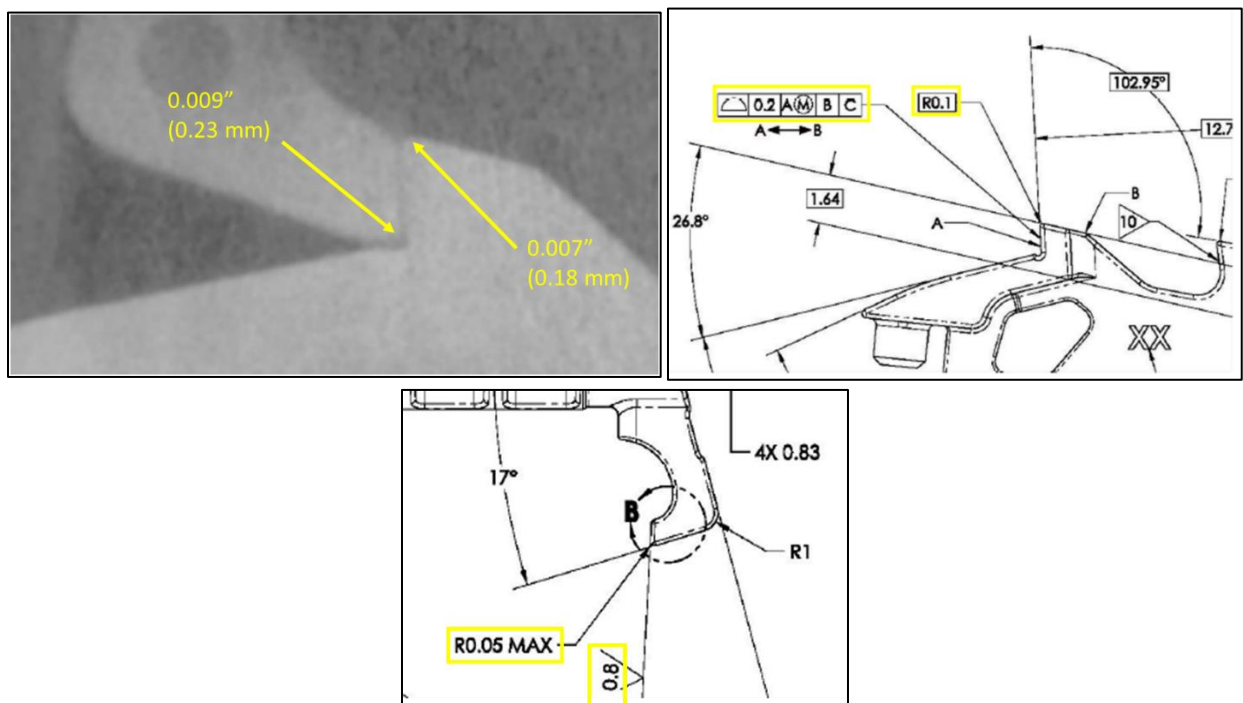


Figure 8 - CT scan of the subject striker and sear (left), sear drawing (right), and striker drawing (bottom)

⁷ Bates SIG-DRAWINGS_00000148

⁸ Bates SIG-DRAWINGS_00000158

5. In addition to the lack of secondary processing on the sear and striker foot, there is also a vertical misalignment of the two parts, as shown in the CT scan shown in Figure 9. The striker foot is unable to fully engage with the sear face surface, reducing the area available for the engagement of the two parts. With the minimal amount of overlap and engagement between the two components, a minor amount of vibration or relative movement between the slide and the grip module would allow the striker to no longer be retained by the sear, and to move forward and discharge a round. In other words, the ongoing relative movement between the slide and the grip module while secured in a Sig Sauer authorized holster over time will allow the striker foot to become disconnected from the sear face. For reference, the contact surface area measured 0.038" (0.2 mm). No documentation has been provided by Sig Sauer that identified what the design specification is for the contact surface area between the striker foot and the sear.

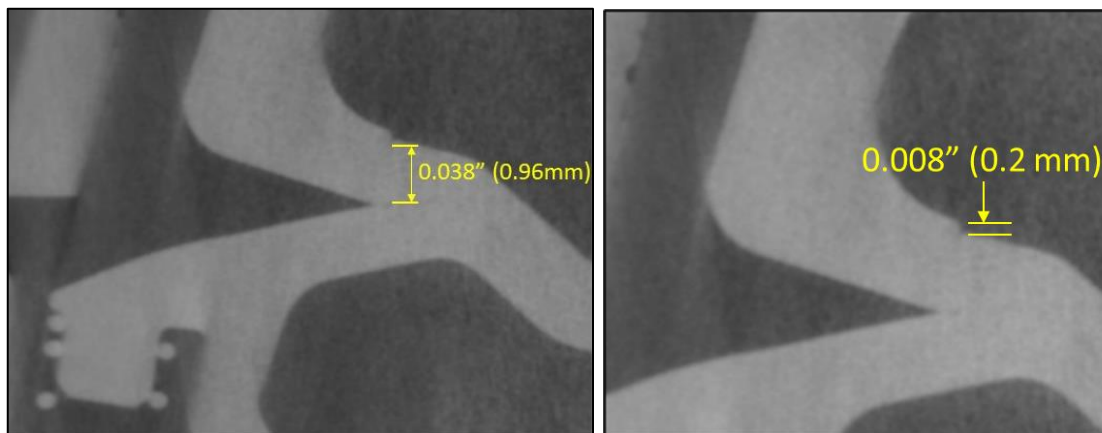


Figure 9 - Subject striker foot to sear contact surface (left) and vertical offset (right)

6. As shown in the CT scan below, there is also a lateral offset between the sear and the striker, causing an unbalanced force on the sear, and off-center contact on the sear. This off-center contact between the two components allows the sear to be loaded laterally, causing the striker foot to make more contact on one side versus the other. When the sear is consistently loaded in one direction due to the misalignment, it contributes to reducing the actual contact surface area between the striker foot and the step in the sear. The CT scan of this offset is shown in Figure 10. Figure 4 above shows the off-center and inconsistent contact area from the striker foot on the sear step.

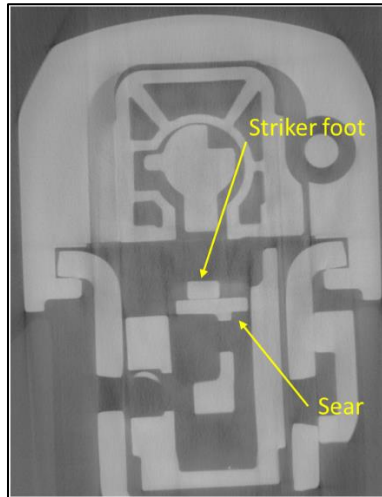


Figure 10 – CT scan slice of striker foot offset to sear

7. In looking at the rear-view CT scan slices of the striker pin relative to the housing, there are gaps within the striker housing, as shown in Figure 11 (left within yellow circle). This allows for axial rotation and movement of the striker pin within the housing each time the firearm is discharged and the slide cycles. This movement will also cause the safety lock tab that makes contact with the parallel horizontal plane of the striker body to become out of alignment, and not parallel, creating a gap. Based on the component drawings supplied by Sig Sauer, the maximum allowable angle of the striker pin to the housing is nearly 4° , however, Sig Sauer had not produced any assembly drawings that documents the specification of the complete striker assembly. The misalignment and rotation will cause minimal contact between the safety lock tab and the rear vertical stop portion of the striker, thereby reducing the contact area between the two surfaces. The misalignment would allow the striker pin to continue its forward movement when the striker foot is no longer retained by the sear, leading to an un-commanded discharge. The misalignment of the safety lock tab to the striker pin is also shown in Figure 11 (right).



Figure 11 - CT scan view from the front of striker gaps to housing (left) and safety lock tab misalignment to striker pin (right)

8. The CT images from Figure 11 (left) above also illustrate the slide assembly gaps to the grip module (circled in blue). These gaps allow the striker foot (as part of the slide assembly) to move vertically and laterally relative to the sear (in grip module) with any vertical and lateral movement, such as that experienced while the firearm is carried in a holster. The frame receiver stamping is not made to specification which contributes to the variation and fitment issues between the slide assembly and the grip module. The horizontal legs are both over 96° from the vertical leg, when the drawing specification indicates 90°. Also, the overall width between the slide tabs measured 21.6 mm, smaller than the 21.81 mm nominal specification. The CT scan is shown below (left) with the frame receiver stamping drawing image (right) in Figure 12. The bottom surface of the receiver tabs are shown as datum "Z" on the Sig Sauer drawing 1301552⁹ and all four tabs have a GD&T callout specifying flatness as 0.1 mm. Since none of the four tabs on the frame receiver stamping are perpendicular or flat relative to datum "Z", the frame receiver component does not meet the drawing specification.

Additionally, the slots machined in the slide where the four frame receiver tabs are retained measured 0.089" (2.28 mm). However, as the slide slot dimensions or tolerances are not identified on any of the slide machining drawings produced, this measurement could not be verified. If these slots were also out of specification (too large), then this would also contribute to the amount of variation and play (sloppiness) between the slide assembly and the grip module. The frame receiver material thickness was measured at approximately 2 mm, with a minimum of 1.9 mm specified on the Sig Sauer drawing.

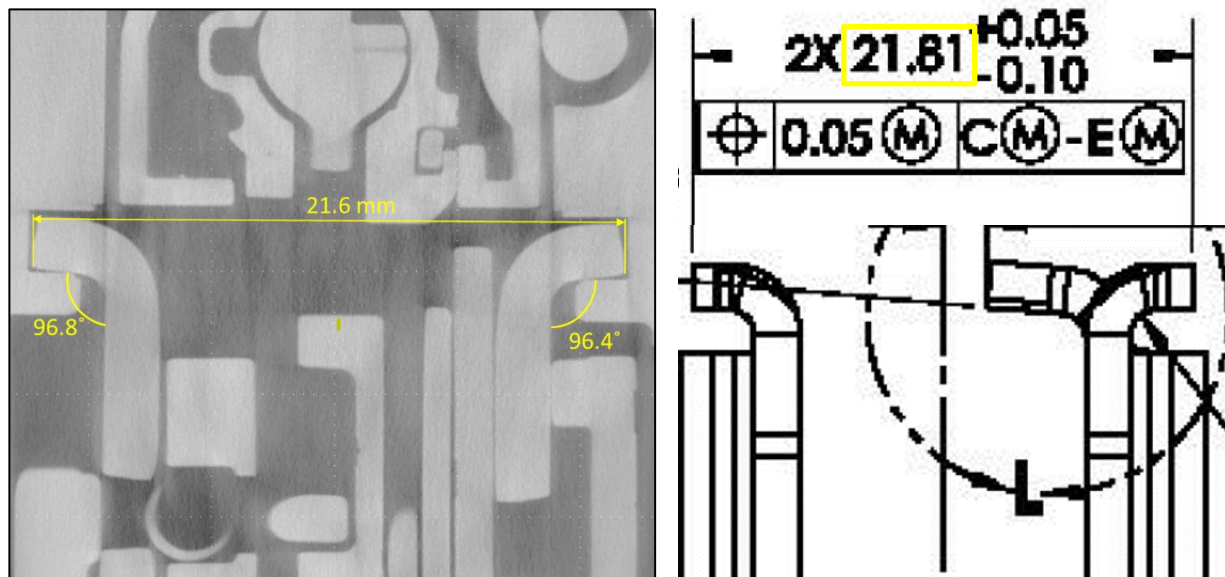


Figure 12 - Receiver stamping measurements from CT scan (left), Sig receiver drawing #1301552

9. Detective Hilton's subject P320 X Carry also did not have the safety lever return spring installed which was used to fully retract the safety lever after the trigger is released. Sig Sauer discontinued the use of this return spring at some point after initiating the P320 upgrade program. The discontinued use of the return spring by Sig Sauer can also contribute to un-commanded discharge as the safety lever does not work as intended if the firearm is carried with the barrel down or upside down, since Sig Sauer designed the safety

⁹ Bates SIG-DRAWINGS_00000118

lever to stay in position with gravity. Since the subject P320 was secured in a Sig Sauer authorized Blackhawk holster in her purse, there is nothing to keep the safety lever in position when the firearm is not kept with the barrel horizontal. Also, any amount of trigger mechanism movement from vibration or inertial forces can create the scenario where it would make contact with the safety lock and move it out of position, and therefore it would not restrain the striker movement leading to an un-commanded discharge. The CT scan showing the discontinued spring and minimal gap is shown in Figure 13 in a muzzle down orientation.

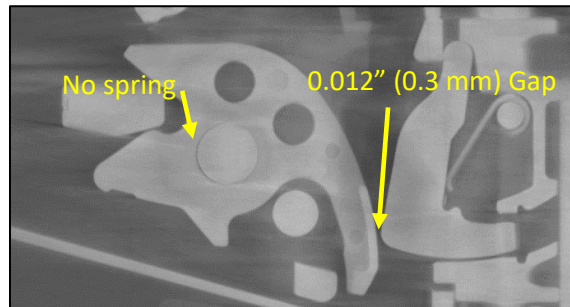


Figure 13 - CT scan of safety lever with no return spring and minimal gap to safety lock

10. In addition to the issues related to the missing safety lever return spring discussed above, as well as the misalignment of these two components, there were also issues noted with the safety lock and the striker stop components. The tab portion of the safety lock had an inconsistent surface, due to being a stamped steel part and unfinished on the area that would engage the striker stop, shown in Figure 14 (left). Correspondingly, the striker stop surface was rounded and unfinished (MIM), as shown in Figure 14 (right). The combination of these two poorly manufactured surfaces would allow the striker to not be restrained by the safety lock, allowing an un-commanded discharge.

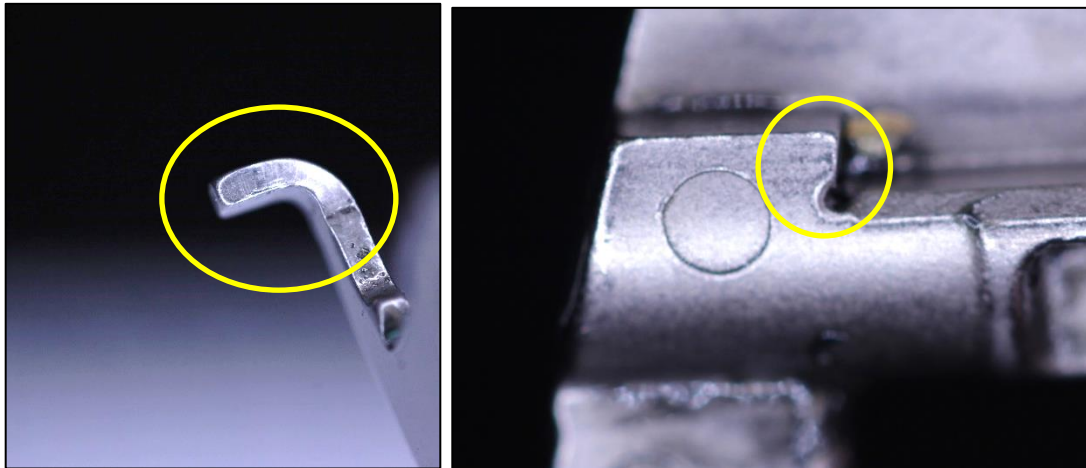


Figure 14 - Manufacturing issues with the safety lock tab (left) and the striker stop (right)

Additionally, the CT scan was utilized to quantify certain safety lock and striker stop measurements. Figure 15 shows the CT scan measurements for the safety lock (top) and the corresponding area from the Sig Sauer drawing #1301029¹⁰ (bottom), which show the safety lock tab is not formed properly at 93°, with

¹⁰ Bates SIG-DRAWINGS_00000365

the drawing indicating 90°, and with a bend radius measured at 0.31" (.79 mm) compared to the drawing specification of 0.028" (.70 mm). The profile of the surface shown in Figure 15 (left) of the safety lock tab, that is intended to come into contact with the striker stop, has a tolerance specified as .008" (0.2 mm). The actual surface quality could not be measured with the CT scan, but it does not appear to visually meet the drawing specification.

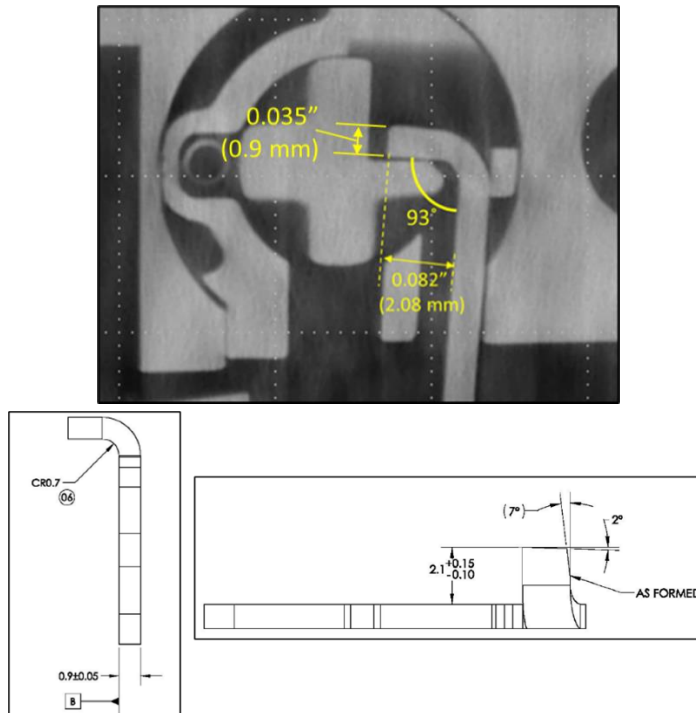


Figure 15 - Safety lock image from CT scan (top), and images from Sig Sauer drawing of safety lock (bottom)

The CT scan was also used to measure and quantify the safety lock and striker stop from a side view. Figure 16 shows the CT scan measurements for the striker stop and safety lock (top and center) and the corresponding area from the Sig Sauer drawings (bottom). These images show the safety lock tab is not formed properly since the 3° gap (which measured at 0.005" or 0.127 mm) is beyond the surface profile designation on the Sig Sauer drawing¹¹ of 0.004" (0.1 mm). The striker stop has a 0.030" (0.38 mm) radius profile and is 0.032" (0.81 mm) high, compared to 0.004" (0.1 mm) and 0.035" (0.9 mm) respectively, from the Sig Sauer drawing #1302193¹², shown in Figure 16 (bottom).

¹¹ *ibid*

¹² Bates SIG-DRAWINGS_00000158

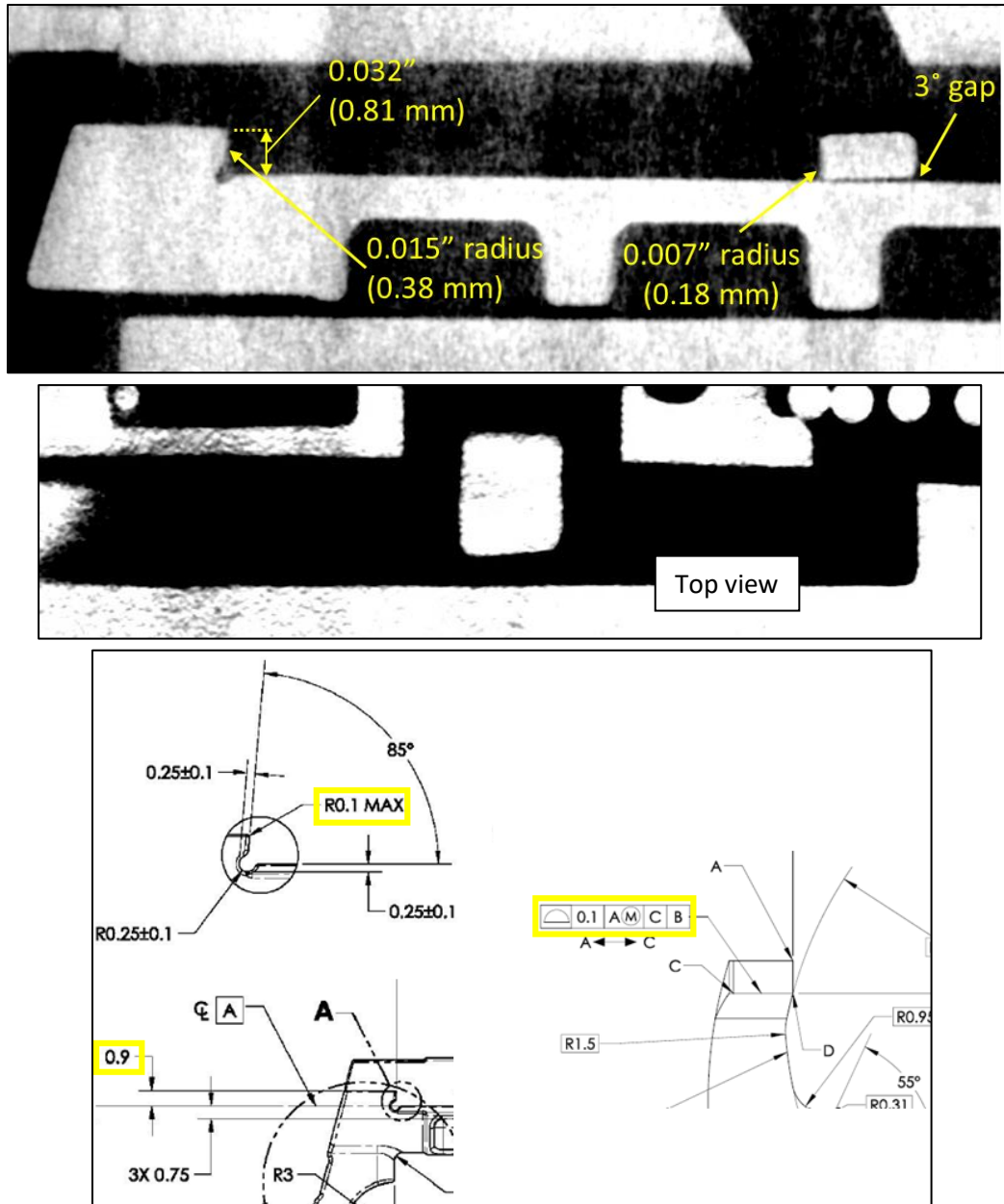


Figure 16 - CT scan of striker stop and safety lock (top), top view of same parts (center), Sig Sauer drawings of the same parts (below)

Since the thickness of the safety lock is specified as 0.035" (0.9 mm), the combination of the quality issues discussed above, misalignment of the striker and safety lock, and possible contact from the safety lever, it means that less than 1 mm of displacement of the safety lock will not stop the striker from moving forward if the striker becomes displaced from the sear without a trigger pull.

11. After the striker assembly had been disassembled, it was noticed that there was a piece of brass lodged in the corner of the striker vertical stop and the center wall area of the striker pin. In its as-found location, the safety lock tab would have made contact with it when the striker was released without a trigger pull. In this situation of having no trigger pull, the safety lock is supposed to come into contact with and stop the forward movement of the striker. Due to the components being out of specification, and the errant

brass found inside the striker assembly, the safety lock would be unable to perform its function. See Figure 17.



Figure 17 - Striker pin with brass debris at vertical stop

12. No unusual wear or significant damage was identified on either the subject firearm or the Blackhawk holster. Normal wear was observed on both. In particular, the trigger appeared to be in good condition with no finish damage or gouges visible. See Figure 18. The damage identified in the Sig Sauer inspection report could not be confirmed. The firearm fit snugly and secure inside the holster and the trigger was well protected. The holster has a locking engagement with the trigger guard, with a lever needing to be depressed by the index finger in order to release the firearm.



Figure 18 - Subject trigger and Blackhawk holster

Sig Sauer Testing

In October 2021, Sig Sauer had vibration testing performed, nearly a year after the subject incident. This has been the only testing documentation produced by Sig Sauer in any of the litigation cases and took place approximately seven years after the P320 was introduced. Sig Sauer did not make anyone outside of Sig Sauer aware of the testing so appropriate representatives could be present. The testing was performed on ten new firearms comprised of different P320 models and included pre- and post-upgrade designs.¹³ The Sig Sauer test request dated September 2, 2021,¹⁴ states that the “*Anticipated Malfunction: Loosening of components, Potential sear disengagement, wear, etc.*”. This test request, as well as the test report, both state that video documentation of each test is to be obtained, but no videos have been produced.

The first tests performed were the vibration tests, which included sinusoidal vibration at various frequencies, and shock (jolt) testing. While the summary report from the testing facility states that no primers were struck, there were at least three tests that “light strikes” were identified from the photographs in the report.¹⁵ Since not all test iteration photographs clearly showed the primer cartridges, there could have been more. Also, these are

¹³ For reference, over 1,000,000 P320 firearms have been produced since its introduction in 2014

¹⁴ SIG-DB000809 – DB000812 – AC225 Rough Handling Test - Sinusoidal Vibration and Jolting Test Request

¹⁵ SIG-DB000198, 216, 230, 231

referred to as “light strikes” in this report, but it is possible the primer was ignited and not noted in the summary report. Examples of photographs showing the “light strikes” are shown in Figure 19.



Figure 19 – Sig Sauer Vibration Test #1 photo #29 (left), photo #30 (center), photo #65 (right) – All with primer light strike marks

Additionally, the vibration test #1, iteration #3 had a trigger stop pin become displaced, as shown in Figure 20.



Figure 20 - Vibration Test #1 Iteration #3 Photo #66 showing trigger stop pin displaced

During the Transportation Bounce Testing, additional issues were noticed reviewing the same test report. In the handwritten notes and typed portion of the test report, the lab refers to two out of ten (20%) of the samples tested with the “sear out of battery” (out of position) while oriented with the “vertical butt down” position.¹⁶ All of the other remarks from the test report reference the sear did not move. As with the vibration tests, not all primer casings are visible in the photographs in the report which does not allow for a complete analysis of the test results to confirm any light strikes.

It should also be noted that none of the tests performed in October of 2021 included firearms secured within holsters, or with testing that would simulate real world conditions while being worn or carried. Sig Sauer has also stated it is unreasonable, extensive, and cost prohibitive, to develop and incorporate a test that would account for the conditions during normal and expected usage. The real-world conditions would include, but not limited to:

- Walking, running, crawling,
- Getting into and out of a vehicle,

¹⁶ Bates SIG-DB000233, DB000236

- Removing and inserting the firearm into a holster,
- Installing and removing a holster from a belt, with a firearm inserted, and,
- The firearm being carried in a holster in a backpack or purse.

Certification Testing

Firearm certification testing is required in California and Massachusetts for any firearm manufacturers intending to sell their products in those states. After passing the firing portion of this certification testing, a primer loaded firearm also must be dropped from a height of one meter onto concrete, in various orientations, with no discharge of the firearm allowed. The SAAMI drop height requirement is four feet and the firearm is dropped onto a high durometer rubber mat.¹⁷ The Sig Sauer P320 is listed on Massachusetts approved firearms roster, but not in California. No other test data has been produced by Sig Sauer on the performance of the P320 relative to these state regulations, their own internal testing, and firearm manufacturer guidelines. While the SAAMI guidelines are voluntary, most manufacturers will test their products to these performance standards to determine the safety and reliability when subject to outside factors, like vibration and being dropped. As stated in the SAAMI standard, "Test parameters simulate conditions where abusive mishandling could possibly result in accidental discharge".

Exhibits

If called upon to testify at trial or hearing, my testimony will reference various exhibits, including the subject and exemplar artifacts, photographs, videos, and other documents produced during this investigation. A more detailed listing of exhibits will be produced in accord with orders of the Court.

¹⁷ ANSVSAAMI Z299.S-1996 - American National Standard Voluntary Industry Performance Standards Criteria for Evaluation of New Firearms Designs Under Conditions of Abusive Mishandling for the Use of Commercial Manufacturers

Summary and Conclusions

The opinions and conclusions detailed in this report are held to a reasonable degree of scientific and engineering certainty. They are based on engineering education, experience, and training, as well as the work conducted to date and the information available at this time. This report will be supplemented as required, based on new information.

Based on the investigation and the work conducted to date, in addition to numerous other similar un-commanded discharge events, the physical evidence described in this report supports Detective Hilton's description of the circumstances of this incident. The Sig Sauer P320 at issue, being carried by Detective Hilton, which was secured in a Sig Sauer authorized Blackhawk holster inside her purse at the time of the un-commanded (no trigger pull) discharge incident, was defective and unsafe for use.

There were several quality and defective issues identified in this report that prevent the firearm to reliably perform as intended under normal usage and conditions. Also, without a manual safety, or a passive toggle safety, normal and expected movement and vibration while holstered caused an un-commanded discharge with a combination of some or all the defective conditions described in more detail in this report, which include:

- 1) Surface quality (no secondary processing) and misalignment of interfacing sear step and striker foot. With both of these parts being out of specification, the striker became disconnected from the sear without the trigger being pulled.
- 2) Surface quality, rounded surfaces, and misalignment of the face of the safety lock tab and the vertical stop face on the striker body, such that both of these areas failed to prohibit the striker from moving forward during the subject event.
- 3) Axial variation and gaps between the striker pin and striker housing with slide movement causes misalignment of the safety lock tab to the striker pin body, and the striker foot lateral position to the sear step face. This occurs after each round is fired and can affect the orientation of the two components each time.
- 4) Ability of the slide (and therefore the striker assembly) to move vertically and laterally relative to the sear reducing the interfacing surface contact area even further, which will cause the striker foot to become disengaged from the sear face. This relative movement occurs while properly holstered from normal body movement and usage of the firearm.
- 5) The striker foot is unable to engage completely on the surface of the sear step due to the changes in the upgraded design, manufacturing processes and lack of secondary machining, and fit-up and variation issues between the parts discussed in this report.
- 6) The removal of the safety lever return spring by Sig Sauer allows the lever to rotate out of position when the pistol is carried in a muzzle down orientation, which can also contribute to the safety lock to be out of position. When this issue is combined with the axial variation described in item 3 above and the part quality issues, it allows the striker to move forward completely when it becomes disengaged from the sear. The safety lock only has to be out of position or out of tolerance by the thickness of the stamping which is 0.9 mm.

- 7) Due to these issues, the redesign and voluntary update program initiated by Sig Sauer has been ineffective in eliminating the un-commanded discharge of the P320 firearm.

Report Prepared by:
Timothy M. Hicks, P.E.

Principal Engineer

IL PE License No. 062-064524

Expires November 30, 2021

**Reviewed and assisted by:**
Roch J. Shipley, Ph.D., P.E., FASM

Principal Engineer

IL P.E. License 062-048091

Expires November 30, 2021



Attachment A



Timothy M. Hicks, P.E.

Principal Engineer

tmhicks@proaaci.com

331-229-3317

2012-Present **Professional Analysis and Consulting, Inc.** – Lisle, Illinois

Performs engineering investigations and failure analysis from a mechanical engineering perspective. Projects have involved design analysis, product liability, intellectual property, manufacturing, accident investigation and reconstruction, fire cause and origin, and component testing. Manages and directs large, complex projects involving multiple parties and disciplines. Vehicle experience includes commercial vehicles, automobiles, RVs, motorcycles, buses, trains, agricultural, and construction equipment. Non-vehicle related projects have involved medical, athletic, and wheelchair accessibility equipment, forklifts, elevators, wind energy systems, lawn equipment, bicycles, plumbing, consumer products, and other mechanical systems. Additionally, he has investigated product packaging failures, aerosol dispenser failures involving impact, projectile and temperature/pressure studies, mechanical design, and systems modeling.

2010-2012 **Packer Engineering, Inc.** – Naperville, Illinois

Senior Director of Engineering responsible for consultation in the areas of failure analysis, accident investigation and reconstruction, product testing, and design review. Managed projects in a broad range of vehicles including automobiles, SUV's, commercial trucks, RV's, buses and coaches.

2007-2010 **Motor Coach Industries International**, Schaumburg, Illinois

Director of Program Management responsible for establishing a new corporate based group of engineers to develop and introduce new product initiatives for all product and processing areas for luxury coaches. Implemented plans to identify cost reduction projects, developed industry leading proposals for new coach development projects, provided recommendations for improving product and program development processes, and identified and pursued alternate suppliers for major systems and modules for coach production.

2004-2007 **Hendrickson International**, Woodridge, Illinois

2005-2007 Senior Engineering Manager responsible for directing three engineering groups that included front suspension, concept development, and elastomers for the commercial truck, school bus, and RV markets. Developed and launched industry-leading high capacity independent front suspension for motor home and fire truck markets, established process and initiatives for generating constant flow of projects in the concept development group to sustain advanced engineering activities.

2004-2005 Senior Engineering Manager responsible for Current Products and Specialty Vehicles product development and process improvement, utilizing CAD, FEA, and ADAMS simulation. Projects included cost reduction, continuous improvement, and warranty analysis for commercial and vocational trucks, school buses, and military vehicles.

1998-2004 **Oxford Automotive Inc.**, Troy, Michigan

2003-2004 Director, Product Engineering that managed product development engineers and CAD/FEA departments for automotive OEMs. Products included metal fabricated, welded, machined and stamped components and systems.

2003 Director, Continuous Improvement that developed corporate strategy for cost reduction initiatives utilizing lean principles and Value Analysis/Engineering techniques

1999-2003 Program Manager who successfully managed suspension module program for a major OEM, taking the project from concept through launch. This included design development, tooling, capital equipment development, quality planning, and manufacturing set-up.

1998-1999 Engineering Manager recruited to develop strategy for suspension module business growth, design development, analysis, prototyping, and validation of suspension module program for a major OEM.

1986-1998 **General Motors Corp.**, Lansing and Warren, Michigan, and Lordstown, Ohio

Progressed through various product engineering roles with increasing responsibilities. Areas of responsibility included product planning, validation and testing, design development, ride and handling, and new product leadership. Products included front and rear suspensions, steering, brakes, engine mounts, drive axles, bearings, ABS/ETS, fuel systems, wheels and tires, jacks and exhaust.

1983-1986 **Progressive Blasting Systems**, Grand Rapids, Michigan

Machine design experience developing CAD skills, and hands on understanding of many manufacturing processes, including welding, machining, assembly, paint, and product quality.

ACADEMIC

M.S. Rensselaer Polytechnic Institute - Engineering Sciences
Management of Technology (1997)

B.S. Michigan Technological University - Mechanical Engineering
Solid Mechanics – Design (1983)

CONTINUING EDUCATION

- Reliability Forecasting, GM (1988)
- Vehicle Dynamics, Kettering (1990)
- Limit Handling, GM (1994)
- Commercial Tire Dynamics, Michelin (2009)
- Traffic Accident Reconstruction Methods, SAE (2010)
- Vehicle Crash Data Retrieval Technician Level 1 & 2, Northwestern University Center for Public Safety (2013)
- Vehicle Crash Data Retrieval Data Analyst, Northwestern University Center for Public Safety (2013)
- Vehicle Dynamics Basics for Off-Highway Trucks, SAE (2014)
- Reconstruction and Analysis of Motorcycle Crashes, SAE (2015)
- Operator Safety Training Program – Forklift Class IV and V, OSHA (2020)
- Crash Investigation and Reconstruction Aerial Photogrammetrist, Northwestern University Center for Public Safety (2017)
- Applying Automotive EDR Data to Traffic Crash Reconstruction, SAE International, (2021)

COMPUTER SKILLS

- CAD/FEA/CAE Tools
- ADAMS Simulation
- MS Office Suite

PROFESSIONAL REGISTRATION AND AFFILIATIONS

- Professional Engineer, State of Illinois (License No.: 062-064524)
- Professional Engineer, State of Michigan (License No.: 6201059697)
- Professional Engineer, State of South Carolina (License No.: 30197)
- Professional Engineer, State of Texas (License No.: 131428)
- Professional Engineer, State of Wisconsin (License No.: 47825-6)
- American Society of Mechanical Engineers (ASME)
- Society of Automotive Engineers (SAE)
 - Chairman, Chicago Section (Current)
 - Crash Data Collection and Archiving Standards Committee (Current)
- National Society of Professional Engineers (NSPE)
- National Safety Council (NSC) Transportation Division (2016)

PATENTS

1. Hicks, Timothy M. and Jennings, Daniel E., “Rear Suspension Mounting Feature and Method,” 6,401,319 (2000)
2. Hicks, Timothy M. and Jennings, Daniel E., “Trailing Twist Axle and Method of Manufacture,” 6,533,300 (2000)

PRESENTATIONS

1. Hicks, Timothy and Shipley, Roch, “Testing – Techniques and Examples – Structural Integrity”, American Society for Quality Presentation, Reliability Division, October 2019
2. Hicks, Timothy, Shipley, Roch, Koehler, Michael, “Testing: Techniques and Examples, Making Evidence-Based Decisions”, American Society for Quality Presentation, Reliability Division, February 2019

Timothy M. Hicks, P.E.

TESTIMONY LIST

Depositions

2017 Nicholas Papanicholas, Jr. vs. ITP #2, LLC, d/b/a Xtreme Trampoline. Circuit Court of Cook County, Illinois, County Department, Law Division, Case No.: 2014 L 0011476

Luke Keuffer and Stephanie Keuffer vs. O.F. Mossberg & Sons, Inc. and John Does 1-5. Montana Eighteenth Judicial District Court, Gallatin County, Cause No.: DV-11-547B

Rebecca Rysewyk et al., individually and on behalf of all others similarly situated vs. Sears Holdings Corporation, et al. United States District Court, For the Northern District of Illinois, Eastern Division Case No. 1:15-cv-4519

Anthony Nunez vs. Direct Auto Insurance Company. Circuit Court of Cook County, First Municipal District, Case No.: 16 M1 116163

Kathleen Brown vs. The City of Chicago, a municipal corporation. Circuit Court of Cook County, Illinois, County Department, Law Division, Case No.: 15 L 6900

Starla Brandon, Individually and as Heir to the Estate of Bruce Drennan, Deceased vs. Clifton Crumbliss d/b/a C & C Asphalt and Paving, TA Operating, LLC, and TA Operating Texas, LLC. District Court of Montgomery County, TX, 410th Judicial District, Case No.: 15-02-01911

2018 George D. Beucher vs. Penske Trucking Leasing Corporation, a Delaware Corporation, Shur-Lock Self Storage, Inc., an Illinois Corporation, and Roger E. Broders. Circuit Court of the Nineteenth Judicial Circuit, Lake County, Illinois, Case No.: 17 L 386

Vivia Harrison, an individual vs. Ramparts, Inc., d/b/a Luxor Hotel & Casino, a Nevada Domestic Corporation; Desert Medical Equipment, a Nevada Domestic Corporation; Pride Mobility Products Corp., a Nevada Domestic Corporation; Does 1 through XXX, inclusive and Roe Business Entities 1 through XXX, inclusive / Desert Medical Equipment, a Nevada Domestic Corporation vs. Stan Sawamoto, an individual. District Court, Clark County, Nevada, Case No.: A-16-732342-C, Dept. No. 1

Monica Roseboro Caesar v. Schindler Elevator Corporation, CESC Gateway Two, Limited Partnership, and Vornado/Charles E. Smith, L.P. Circuit Court of Arlington County, Virginia, Case No.: CL-17-001099-00

2019 Carolyn Scholz, Frank Scholz, and Birgit Scholz vs. Ride the Ducks International, LLC; Ride the Ducks of Seattle, LLC. Superior Court of Washington for the County of King, Case No. 17-2-22720-0 SEA

Graciella Sanchez vs. Alejandro Pantoja. Circuit Court of Cook County, Illinois, County Department, Law Division, Case No.: 2017 L 009007

Timothy M. Hicks, P.E.

TESTIMONY LIST

Shuttlewagon, Inc. vs. Scott Higgins, Emily Coon, Charles Donald Crist, John L. Ying and Innovative Quality Solutions, LLC. In the Circuit Court of Jackson County, Missouri, at Kansas City, Case No.: 1816-CV07674

2020 Jeremiah McDaniels and Stella McDaniels vs. Wolverine World Wide, Inc., Vibram USA, Inc., Safety Shoe Service, Inc., Hytest Safety Footwear, and John Getchell, a Citizen of Indiana. Porter Superior Court, State of Indiana, 64D01-1510-CT-008639

Estate of Roger R. King by Robert Wilmink, Executor vs. McElroy Coal Company, Consol Energy, Thiele GmbH & Co., Murray Energy, et al. Circuit Court of Marshall County, West Virginia, 15-C-169

Brenda Shattuck, as Administrator of the Estate of Walter DeGroff, Deceased vs. Ford Motor Corporation, JMJ Farm Holdings, LLC., Joseph Jingoli, Jr., Joseph Jingoli & Son, Inc., United Rentals, Inc. Supreme Court of New Jersey, Mercer County, Law Division, MER-L-1776-18

2021 W.S.R., an infant by and through his father, William Richardson, and William Richardson and Nicole Richardson, individually vs. FCA US LLC, Yanfeng US Automotive Interior Systems II LLC (a/k/a Yanfeng Automotive Interior Systems), Adient PLC, and Johnson Controls, Inc. / FCA US, LLC vs. JCIM, LLC. United States District Court, Southern District of New York, 7:18-CV 06961

Gordon Wietting vs. Commonwealth Edison Company and Sunbelt Rentals, Inc., Imperial Crane Services, Inc., Genie Industries, Inc., Terex Corporation and Terex South Dakota, Inc. Circuit Court of Cook County, Illinois, County Department, Law Division, Case No.: 18 L 003430

Michael Santos, as Plenary Guardian of the Estate and Person of Viola Santos vs. City of Chicago, and Builders Chicago Corporation. Circuit Court of Cook County, Illinois, County Department, Law Division, Case No.: 18 L 004609

Kelley's Trucking, LLC vs. Atkinson Truck Sales. Circuit Court for Pennsylvania County, Case No.: CL180001623-00

2022 Stephen Mayes v. SIG Sauer, Inc.: United States District Court, Eastern Division of Pennsylvania (Philadelphia), Case No.: 2:20-mc-00105-JMY

Kyle Guay v. SIG Sauer, Inc. United States District Court, District of New Hampshire, Case No.: 1:20-cv-00736-AJ

Jimmy S. C. Jinn vs. SIG Sauer, Inc.: United States District Court, Southern District of New York, Case No.: 1:20-cv-01122-PGG-RWL

Timothy M. Hicks, P.E.

TESTIMONY LIST

Don Esbjornson vs. Black Dog Speed Shop, Inc., an Illinois Company, Gaples Enterprises, Inc., d/b/a Black Dog Racing, Inc., an Illinois Company; Tony Gaples, an Illinois Resident; Ray Sorenson, an Illinois Resident; and Joel Justus, an Illinois Resident; Dick Behrendt, an Illinois Resident. Circuit Court of the Twelfth Judicial District, Will County, Illinois, Case No.: 2015 L 000546

Cheryl Russell, Executrix of the Estate of Joyce A. McKemie, deceased vs. Christian Homes, Inc., d/b/a Washington Christian Village / Christian Homes, Inc., d/b/a Washington Christian Village vs. Invacare Corporation. Circuit Court of the Tenth Judicial District, Tazewell County, Illinois, Case No.: 2018 L 000019

Arconic Inc. vs. Novelis Inc. and Novelis Corp. United States District Court for the Western District of Pennsylvania, Case No.: 17-1434

Timothy M. Hicks, P.E.

TESTIMONY LIST

Trials

- 2017** Kathleen Brown vs. The City of Chicago, a municipal corporation. Circuit Court of Cook County, Illinois, County Department, Law Division, Case No.: 15 L 6900, Judge Gregory J. Wojkowski
- 2018** Kathleen Brown vs. The City of Chicago, a municipal corporation. Circuit Court of Cook County, Illinois, County Department, Law Division, Case No.: 15 L 6900, Judge Gregory J. Wojkowski (retrial)
- Anthony Nunez vs. Direct Auto Insurance Company. Circuit Court of Cook County, Illinois, County Department, Chancery Division, Case No.: 16 M1 116163
- Randy G. Pate, Sr. vs. Pace Suburban Bus Division of the Regional Transportation Authority, a municipal corporation, Jocelyn Etienne. Circuit Court of Cook County, Illinois, County Department, Law Division, Case No.: 17 L 236
- Viva Harrison, and individual vs. Ramparts, Inc., d/b/a Luxor Hotel & Casino, a Nevada Domestic Corporation; Desert Mechanical Equipment, a Nevada Domestic Corporation / Desert Medical Equipment, a Nevada Domestic Corporation vs. Stan Sawamoto, an individual. District Court, Clark County, Nevada, Case No.: A-16-732342-C
- 2019** Graciela Sanchez vs. Alejandro Pantoja. Circuit Court of Cook County, Illinois, County Department, Law Division, Case No.: 17 L 0009007
- 2020** Shuttlewagon, Inc., a Delaware Corporation vs. Scott Higgins, Emily Coon, Charles Donald Crist, John L. Ying, Innovative Quality Solutions, LLC. Circuit Court of Jackson County, Missouri, Case No. 1816-CV07674, Division 18
- 2021** The People of the State of Illinois vs. Jared M. Queen. Twentieth Judicial Circuit, County of Washington, Case No.: 2019-CF-40
- 2022** The State of Nevada vs. Elizabeth Vallaster. Justice Court of New River Township, County of Churchill, State of Nevada, Case No.: 20 CR 00519
- Commonwealth of Pennsylvania vs. Brandon W. Bostian, Philadelphia Municipal Court and Common Pleas, County of Philadelphia, Case No.: MC-51-CR-0014115-2017
- Kyle Guay v. SIG Sauer, Inc. United States District Court, District of New Hampshire, Case No.: 1:20-cv-00736-AJ



2022 Fee Schedule

General:

- After professional services have been agreed upon, services will be billed periodically (typically monthly) as work progresses
- Payment is due within 30 days of date of invoice
- Additional equipment usage fees may apply
- Deposition and court testimony are billed in half-day time blocks
- Travel time is billed portal to portal (unless other arrangements have been made)

Professional Services (in U. S. Currency):

- | | |
|--|----------------------|
| • Administrative Support Staff | \$50 – \$90 per hour |
| • DeFilippi, Louis J., Ph.D. | \$370 per hour |
| • Hicks, Timothy M., M.S., P.E. | \$295 per hour |
| • Koehler, Michael G., Ph.D., ACSF | \$310 per hour |
| • Laun, Johannes C., P.E., IAAI-CFI, MIFireE | \$290 per hour |
| • Leckie, Glen K., P.E. | \$240 per hour |
| • O'Neill, John A. FAA A&P/IA | \$250 per hour |
| • Shipley, Roch J., Ph.D., FASM, P.E. | \$405 per hour |

Additional staff may be involved as required

Charges for Expenses:

- | | |
|------------------------------------|---------------------------|
| • Automobile Travel | 58.5¢ per mile (IRS rate) |
| • Other Travel and Lodging | Cost – no mark up |
| • Specialty Supplies and Materials | Cost – no mark up |
| • Outside Lab Services | Cost – no mark up |

Equipment, Supplies, and Reference Materials

- Charges and rental fees may apply for specific laboratory testing, field inspections, supplies, equipment, and reference materials.

Case-Related Artifact Handling and Storage

- Licensed Private Detective Agency holding Private Detective License in accordance with 225 ILCS 447 for retaining evidence.
- In compliance with ASTM Standard for evidence handling.
- Initial Receipt of Subject Artifact, Chain of Custody documentation and photography of evidence.
- Storage and Evidence Records Management Fees of subject and exemplar artifacts/evidence will be billed quarterly.

Hosting of Joint Party Inspections

- Arrangements made on a case specific basis **\$500 per day**
(Professional assistance, food, and beverages are supplied at additional cost.)

Attachment B

**Professional Analysis
and Consulting, Inc.****Hilton v. SIG Sauer**

Project No.: 2017

	Classification	Description
1.	Background from Client	SIG-DB_000001-000812
2.	Background from Client	SIG-DRAWINGS_000001-000371
3.	Background from Client	SIG-QC 000001-000092
4.	Background from Client	https://abcnews.go.com/Nightline/video/detective-sues-sig-sauer-holstered-p320-pistol-wounded-79633594
5.	Background from Client	https://abcnews.go.com/US/detective-sues-sig-sauer-holstered-p320-handgun-killed/story?id=79605906
6.	Deposition	Deposition of Brittany Hilton taken 07/12/2022 with exhibits
7.	Inspection	Inspection photos and CT scans
8.	Legal	Plaintiff's Original Complaint
9.	Video	Miscellaneous videos re un-commanded discharges